

**LOW-VELOCITY SPALL TESTING OF TI-6AL-4V ALLOY  
AND NEW SPALL CRITERION BASED ON MESOSCALE**

**First interim Report**  
(June.17/2002 – Sept.16/2002)

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## EXTENDED ABSTRACT

During the first period (three months from June 17/2002 to Sept. 16/2002) of the Contract the experimental program was setup to test Ti-6Al-4V alloy by so called plate-plate impact technique. The main purpose of this study is to clarify, using spall experiments, the role of short-time local plastic fields occurring in the meso-scale. The thermal coupling and the local high strain rates will be considered in the modeling.

The Laboratory of Physics and Mechanics of Materials is equipped, besides Hopkinson bars in compression and torsion, in the plate impact facility with bore diameter 57 mm. A flyer plate can be accelerated up to 800 m/s depending on the gas that is used. A series of spall tests are planned with different target/flyer thickness. A critical minimal impact velocity will be sought when the incipient spall occurs at loading times from ~600 ns to ~2.5  $\mu$ s. The specimens in the form of disks of different thickness and DIA 57 mm have been delivered by AMSRL-WM-TA, APG Aberdeen, MD. The plate impact facility is in the stage of preparation, including an automatic procedure of the launching.

Since an observation of the spalled surfaces is envisaged, more exactly the surface topography in 3D, two new high resolution profilometers, one based on the light interferometry (laser interference): WYKO NT1000 by VEECO, and the second: MAHR Profilometer, based on mechanical contact, have been put into operation. Both profilometers are equipped in a sophisticated software which has been already tested. The software permits for a detailed analysis of the surface profiles in 3D including statistics. Preliminary analysis of the spall surfaces available after previous tests are in progress.

After previous projects on Ti-6Al-4V supported by the European Research Office of the US Army an ample data are available obtained in fast shearing which will permit to identify all material constants in a constitutive relation developed in LPMM.

During last years, within the framework of the previous projects on spall mechanics, advances in understanding fracture in the meso-scale are quite obvious. A review of fracture criteria will permit to make a correct choice for the Finite Element codes, [1]. Studies on mechanical and microstructural aspects of spall have provided further data on armor steels and hard aluminum alloy, [2,3]. A new model of spall fracture will be developed for Ti-6Al-4V based on the plate impact experiments, microscopic observations and topography analysis.

## References

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